"Scientific and Research Productivity of Engineering Colleges in Karnataka: A Scientometric Analysis''

1. Introduction

The purpose of this research is to provide a comprehensive picture of engineering research activities that are carried out and published by engineering colleges and institutions in the state of Karnataka. The job of systematically documenting and communicating the outcomes of scientific studies via publications is a challenging one.

The analysis of research data provides assistance in making strategic judgments on which subfields of study need further funding. In order for the head of the institution or university to have a better understanding of where the institution stands in comparison to global or national norms of research output, it is helpful to quantify how much research has been carried out. What kind of effects does it have? the number of papers that its faculty members have had published in journals that have a high impact factor; whether or not the amount of research output creation is growing; an author's citation value and h-index; etc. Utilizing methods such as counting, measuring, comparing numbers, and analysing measurements are examples of some of the approaches that may be used in quantitative analysis in order to undertake research performance evaluation. On the other hand, articles published in journals with high impact based on citations refer to the quality of a specific author, and the calculation of the The H-index also allows for qualitative examination.

Universities, government agencies, and other professionals need to be knowledgeable about the research that should be sponsored and which research projects should get more funding than others.

2. Review of Literature

A number of scientometric studies have been done in the area of Science & Technology in India. An article on activity and growth of Organic Chemistry research in India has been published by Karki et al. (2000) during 1971-1989; Kademani et al. (2006) conducted "a study on Scientometric dimensions of Nuclear Science and Technology research in India: A study based on INIS (1970-2002)"; Kademani et al. (2006) studied on "Scientometric dimensions of Thorium research in India"; Kademani (2008) wrote a paper on"Scientometric mapping of Vacuum research in Nuclear Science and Technology"; Mahbuba et al. (2010) published on "Scientometric analysis of Health and Population research in South Asia particularly of two research organizations"; Gupta (2010) conducted a comparative study of Science & Technology

publication output of India, China and South Korea during 1998-2008; Sanni et al. (2013) published a paper on "evaluating the growth pattern and relative performance in Nipah virus research from 1999 to 2010"; Yang and Lee (2013) studied on "Bibliometric approach to research assessment: publication count, citation count& author rank"; Chuang et al. (2013) wrote high-impact paper published in the journal of chemical engineering .The system, already existing in case of patents worldwide. Countries like China and South Africa have already taken such initiatives and as a result could monitor their research output effectively.

Deka (2020) scrutinized the research productivity of the Dibrugarh University from 1989 to 2020 based on the Web of Science Database. The results showed that the literature grew every year, with 2019 being the most productive year ever. Department of Chemistry was extremely prolific and the USA was the most cooperative country in research. Dibrugarh University engaged with scholars from 45 different countries, resulting in highly collaborative works by both national and foreign authors.

Bid & Mandal (2021) compared the research output of the University of Burdwan(BU) with the University of Kalyani (KU) between 2000 and 2019 as reflected in the Web of Science database. The universities of Burdwan and the University of Kalyani published 2985 and 3074 research publications with 41405 and 40895 citations respectively. The researchers discovered that the citation pattern among research articles at the two universities under investigation is nearly identical, and that collaborative publication are more frequent than single-authored studies.

Hamdiya et al**.** (2021) conducted a scientometric analysis to assess the research publications of researchers at the Indian Institute of Science from 2000 to 2019 that were indexed in the Web of Science database. Biblioshiny and MS Excel were used to exam Under such centralized system of data collection, research profiles of scientists could also be generated by age, gender, social and educational background, besides linking them with sources of funding and proper classification system. Such features would definitely enhance usefulness of such a database to user organizations and policy-makers.

3. Need and Importance

As a result of this research, suitable quantitative measurement methods, now known as scientometrics, were identified and used. Scientometric studies have been used by libraries and information scientists all over the world to shed light on the pattern of growth of Literature, obsolescence studies, collaborative research, journal rankings, connections between various

disciplines of knowledge, author productivity and impact, collection building and usage patterns, and other themes.

The growth of engineering college research literature increased at an exponential rate, but the rate of growth also varied from one discipline to another and among the branches within a discipline. Furthermore, the growth rate of engineering college research literature increased at an exponential rate. Understanding the characteristics of literature, such as growth and scatter, collaborative research trends, obsolescence patterns, highly productive journals, engineering college research productivity, and utilisation and consumption in planning and designing information systems, is useful in developing need-based collections of resources, proper planning of library services, and solving some library problems. It is the need of the hour to understand the characteristics of literature, such as growth and scatter, collaborative research trends, obsolescence pattern, highly productive journals, and research productivity. As a result, a project titled "Scientific Productivity of Engineering Colleges in Karnataka: A Scientometric Study" has been accomplished as a part of the ongoing study.

4. Statement of the Problem

The title of the thesis is “Scientific and Research Productivity of Engineering Colleges in Karnataka: A Scientometric Analysis”

In recent years, scientometric studies have mostly been done to figure out how research on a subject has grown and what effect it has had. Very few studies have been done that look at all aspects of an engineering field.

In the literature, we haven't found any studies in scientometrics that look at how productive Visvesvaraya Technological University-affiliated engineering colleges are. The goal of this study is to look at both the numbers and the quality of the results from the VTU-affiliated engineering colleges in Karnataka.

"Scientometrics is the study of how scientific activity, productivity, and progress can be measured and compared."

5. Objectives

The main objective of this study is to present the ranking of engineering colleges based onthe growth of research and development (R&D) literature published by the scholars in any discipline and their citations since their inception. In particular, the study focuses on the following Objectives.

1. To identify the research output of VTU affiliated Engineering Colleges in terms of type of publication, Subject and chronology.
2. To know chronological distribution of Subject wise research output in various Engineering Colleges
3. To find out the top collaboration among the participating institutions.
4. To find out the highly preferred journals during the period of study.
5. To seek the factors responsible for better research environment.
6. To illustrate the subject wise breakup of research documented in scholarly publications.
7. To visualize the collaboration and co-citations network of research publications.
8. To assess the Institution wise research concentration on science and technology research output.
9. To identify the most productive research institutions and centres of excellence is based on quantity, quality and consistency indicators.
10. To identify journal wise distribution of publications research output.
11. To suggest a rationale strategy for research development in engineering colleges in Karnataka on the basis of analysis and findings of the study.
12. To identify the funding agencies, support for Engineering Colleges in Karnataka

6. Hypothesis

The following hypotheses have been formulated with a view totest the above framed objectives by employing appropriate statistical tools

1. The relative growth rate shows an increasing trend while doubling time increases.
2. There is no correlation between the number of publications and number of funded research.
3. The eldest colleges have the more activity index.
4. There is no significant correlation between citation and international collaborative authors.
5. The Lotka's Law of scientific productivity does not confirm for the publication output of
6. The journal source of publication in Engineering colleges research output absorbs the predominant place in comparison with other source of publication.

7. Scope and Limitations

The scope of the current research is limited to Visvesvaraya Technological University's affiliated Engineering Colleges in Karnataka (VTU) which are established before in the year 2005. National Institutional Ranking Framework (NIRF), National Board of Accreditation (NBA), and National Assessment and Accreditation Council (NAAC) are the three organisations that make up this ranking system. All regard Web of Science (WoS) and Scopus to be the gold standard among legitimate, standard citation databases (NIRF). Research articles that are indexed in the Scopus database were taken into consideration for this study because of its greater scope

The study looks at the Scopus-indexed scientific communications. The study does not include research that has been published in regional languages or on a national level but is not indexed in Scopus. Nearly every research article is published in English since the subject of the current investigation is technical publications. In order to acquire a thorough view of the research output of the institution, it might be advised that additional study be expanded by gathering data from the Indian Citation Index as the bulk of Indian publications are not covered by Scopus.

It is very difficult to perform a research that is absolutely error-free or that can cover every conceivable angle. Current research falls under this category as well, with restrictions on the databases utilised, the time period covered, the number of institutions included, the types of publications published, etc. The list of restrictions is below.

- By type of Investigation : Scientometric Study
- By Period of Study : 2001 to 2022 (twenty years).
- By Types of Publications : Only Research Publications
- By Source of Publication : Online Bibliographic Database
- By No. of Institutes covered : 2005 before established 70 Engineering Colleges affiliated to VTU, Karnataka
- By No of Bibliographic Database : One
- By specific title of the e-Database : Scopus

8. Methodology

Methodology is a term that is used in the context of research, and it refers to the organised, practical, and theoretical examination of the approaches that are used to study a certain topic. The

data for the study were retrieved from the prominent worldwide scientometric databases, i.e Web of Science (WoS) and Scopus. These two databases have been deemed to have the greatest level of trustworthiness and dependability by researchers and experts from all around the globe. By using suitable search syntax, records pertaining to VTU affiliated engineering colleges in Karnataka state in the address field were downloaded for the period of 2001 to 2022. Recently, researchers around the world have begun to make extensive use of these databases to systematically compare scientific institutions and geographic regions across scientific disciplines.

The present study is a scientometric study, which practices quantitative methods. It is also termed as "bibliometric approach". Application of several mathematical and statistical techniques, methods and models would be used for various facets in the present investigation.

Below is brief research methodology used in the present research -

a. Data Collection

The SCOPUS database on engineering colleges in Karnataka, which spans a period of 20 years beginning in 2001 and ending in 2022, was used to obtain data for this specific research. The increase in the amount of literature throughout the study period was measured by the researcher using information gathered from the Scopus database for the years 2001 through 2022. The literature was analysed to learn more about the journals' distribution, the writers' tendencies, the institutions' own research findings, etc. The foundation for calculating the aforementioned metrics was the research output of engineering college faculties linked with VTU, which included 26938 articles. The collected data had been analysed in order to achieve the objectives of this study. This data analysis includes a descriptive analysis in addition to the use of several scientometric tools and statistical algorithms to analyse the downloaded data.

Data is extracted from Web of Science and Scopus database published by ThomsonScientific (USA), now known as Clarivate. Search in the database was done using precise search terms for each year. The period considered is 2001-2022. Data was downloaded in tab delimited text files for each year.

b. Data Tabulation

Collected data was imported into MS Excel application and then tabulated using various features and functions of Excel. Graphs and charts required are also generated using Excel.

c. Data Analysis

Both absolute and relative indicators are used for scientometrics analysis. Publications count, journals count, citations count etc are the example of absolute indicators.

International Collaboration rate or Collaboration Index (CI), Inter-Institutional collaboration rate etc. are the example of Relative Indicators.

Various theories have been evolved in the form of bibliometric and scientometrics laws and models to assess the scientific productivity. Those laws, such as Bradford's law, is tested during the study.

9. Organization of the Study

Following is the outline of the thesis which gives an overview of the content of each chapter:

Chapter 1 is an introductory chapter and provides an overview of the problem being addressed in the thesis, together with the aims, research questions, and rationalebehind the study. The chapter also outlines the methodology, scope and limitations.

Chapter 2 presents a comprehensive review of literature collected from varioussources. Previous literature related to Bibliometrics, Science and Technology growth, research productivity of various institutes, comparative studies comparing publication growth among institutes, etc. is reviewed.

Chapter 3 elaborates on Research Design in which attempts are made toanalyze and interpret the data to unmask logical answers to the questions/hypotheses posed in the first chapter. This chapter contains the descriptive material related to methodology and the steps taken to fit to different bibliometrics indicators or models.

Chapter 4 provides an elaborate description of the Development of Bibliometrics and Scientometrics, as well as shows its importance in Library and information science. It highlights the different bibliometrics indicators and their importance for the present study and reviews identical studies conducted earlier using different indicators.

Chapter 5 is Data Analysis provides the results of the thesis and addresses the main objectives of the thesis and also discusses what has been achieved.

Chapter 6 describes the Summary Conclusion, Summary of Findings and Suggestions for further Study. This chapter provides a conclusion of the study and indicates some of the further analysis and future work to be undertaken as an extension of this investigation.

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